(19) **FEDERAL REPUBLIC OF GERMANY**	(12) **Patent document for publication** (11) **DE 196 16 526 A1**	(61) Int. Cl.[6]: B 23 Q 1/25 B 23 C 3/18 B 24 B 13/00
GERMAN PATENT OFFICE	(21) File no.: 196 16 526.1 (22) Application date: April 25, 1996 (43) Publication date: Nov. 6, 1997	

(71) Applicant: Jung, Rainer, 57290 Neunkirchen, DE (74) Representative: Hemmerich, Müller & Partner, 57072 Siegen	(72) Inventor: Same as Applicant

(54) Machine for material-removing processing of optical materials for the manufacture of optical parts

(57) What is proposed and described is a machine (1) for material-removing processing of optical materials, e.g. for the manufacture of eyeglass lenses, wherein the processing tool 19 is arranged relative to the tool 23 so as also to be controllably swivelable around an axis B-B, which extends at a right angle to a plane defined by both coordinates of a rectangular or Cartesian coordinate system. Thereby, this swiveling displacement axis B-B is always maintained in an alignment or cover position relative to a midpoint M or a center for the cutting course of the processing tool 19 around the spindle rotation axis A-A, and the swiveling displacement axis B-B also always extends at a right angle to the rotation axis A-A of the processing tool 19. The angle support 12 is displaced around the swiveling displacement axis B-B by a servo motor 14, which is in computer-controlled connection with a servo controller 24.

The following data are taken from documents submitted by the applicant

Description

The invention concerns a machine for material-removing processing of optical materials for the manufacture of optical parts, especially for the manufacture of eyeglass lenses, with spherical, aspherical, toric, atoric, cylindrical or other optically effective surfaces, by means of milling and/or grinding processes, as well as polishing processes. This machine includes:

- a spindle head with a rotating spindle, on the free end whereof is a workpiece holder for an optical body, for example, a block clamping device for a lens blank,
- a drive head with a rapidly rotating spindle for the holding of a processing tool, for example, a milling cutter or grinding head,
- two supports or skids, which are adjustably arranged relative to each other and to a base frame in a rectangular or Cartesian coordinate system,
- an angular support, by means of which the processing tool can be brought into the processing positions relative to the workpiece holder and/or the optical body,
- whereby, by means of the supports or skids which can be adjusted within the coordinate system, the processing tool can be positioned and engaged against the workpiece and/or the optical body,
- whereby one of the supports or skids is adjustably oriented in the direction of and/or parallel to the axis of revolution of the spindle and workpiece holder on the spindle head, and the other support or skid is adjustably oriented perpendicular to the axis of revolution of the spindle and workpiece holder on the spindle head,
- and whereby the plane of the axis of the drive head and the processing tool, which extends parallel to a plane defined by both coordinates of the coordinate system, coincides with the axis of revolution of the workpiece holder and spindle on the spindle head.

A machine of the configuration described above has already been disclosed in DE 41 35 306 A1, together with a process and a system for surface processing and edge trimming of an eyeglass lens blank.

In addition, DE 41 35 306 A1 discloses a plurality of information, requirements and conditions, which are of significance for the processing of optical parts, especially eyeglass lenses, on the basis of specific prescription data.

The respective prescription data are input into an electronic computer – for example, by means of an input unit – and processed therein, in order to exert an influence on a servo controller. The servo controller converts the prescription data, which were transformed by the computer into numerical machine operation data, into movements of drive motors and/or servo motors, one of which adjusts or positions the respective angle of rotation of the workpiece holder with the optical body around the spindle head axis, relative to the processing tool. Two additional servo motors are used to determine the axial and the radial position between the workpiece or the optical body and the processing tool at any given moment in time. Each individual processing point on the workpiece or optical body – out of a very great number of processing points, which, in combination, define the shape of the optically effective surface of the optical part (eyeglass lens) specified by the prescription data – thus consists of three coordinates.

At each individual processing point on the optical body or lens blank for the eyeglass lens, the processing tool interacts with a circumferential line area, which, on one hand, depends on

the angular position (predetermined by means of the angular support) of the axis of rotation of the processing tool relative to the plane of rotation, on which the workpiece holder which holds the optical body rotates by means of its spindle in the spindle head. On the other hand, however, the circumferential line area of the processing tool which acts upon the optical body or lens blank at the given moment in time is determined by the axial and radial spatial position of the appropriate processing point, as specified in the prescription data, relative to the point of origin 0 of the optically effective surface concerned. The circumferential line areas of the tool which become effective with regard to the workpiece or optical body, and thereby the cutting conditions, also change constantly, along with the continually changing spatial position of the individual processing points relative to the point of origin 0 of the optically effective surface concerned. The above especially applies to the clearance angle – that is, the angle between the cutting area of the workpiece and the clearance surface of the cutter; the chip angle – that is, the angle between the perpendiculars to the cutting surface and the chip surface; and the cutting angle – that is the angle between the cutting surface and the chip surface.

Obviously, this type of surface processing of a workpiece (lens blank) used to form an optical body cannot be free of errors, and the processing errors peculiar to this milling and/or grinding process can only be corrected by means of a subsequent polishing process, which involves corresponding effort and expense.

An additional disadvantage lies in the fact that, as a function of the mode of operation of the machine known from prior art, only tools with relatively small diameters can be used. This is because, especially when working with tools with large diameters, there is a risk that the peripheral areas of the optical body (lens blank) being processed will be damaged in an extremely undesirable way.

The objective of the invention is accordingly to overcome the inconveniences peculiar to the machine known from prior art and described above and to facilitate the material-removing processing of optical materials for the manufacture of optical parts, especially for the manufacture of eyeglass lenses. Accordingly, the invention is based on the task of improving the machine characterized by the configuration described in detail above, so as to enable the attainment of a higher degree of precision, at least in the performance of the milling and/or grinding processes on the optical bodies, especially lens blanks. In addition, however, the invention should provide the possibility of using tools with larger diameters for the processing of the optically effective surfaces on the workpieces, in order to obtain better chip production and improved cost-effectiveness.

It has been found that the solution of this relatively complex task is amazingly simple to achieve, when:

- the angular support, with the drive head and the processing tool, is arranged so as to be swivelable, in a controlled matter, around an axis which extends at a right angle to a plane defined by both coordinates of the coordinate system,
- this swiveling displacement axis is always maintained in an alignment or cover position relative to a midpoint (center) for the cutting course of the processing tool around the spindle rotation axis of the drive head,
- and this swiveling displacement axis is also constantly maintained at a right angle to the rotation axis of the drive head and/or the processing tool,

- whereby, in addition to the drive motor or servo motor of the tool-holding spindle and the servo motors for both supports or skids, an additional servo motor for this swiveling displacement axis of the angular support is in computer-controlled connection with a servo controller.

In addition to the rotation axes of the workpiece holder and the processing tool, and in addition to both of the coordinate axes of the rectangular or Cartesian coordinate system, the machine according to the invention accordingly also provides a fifth axis of motion. This axis, in a computer-controlled matter, also affects the engagement and positioning of the processing tool relative to the optical body, especially the lens blank for an eyeglass lens, which is to be subjected to processing. This especially has the effect of ensuring that at least the milling and/or grinding processes, by which the optically effective surfaces are formed on the optical bodies, especially on lens blanks for eyeglass lenses, take place with a precision which significantly reduces or minimizes the subsequently required polishing process.

In a further embodiment of the invention, it is proposed that the angular support should be provided and/or arranged so as to be displaceable by an angle of up to 90° in both a clockwise direction of rotation and a counterclockwise direction of rotation around the swiveling displacement axis, relative to a starting position oriented on the rotation axis of the spindle and tool holder on the spindle head. This especially guarantees that all available forms of construction of processing tools may be used without difficulty for the material-removing processing of the optical material. In this connection, it is especially important that, according to the invention, the cutting course of the processing tool can be provided with a defined diameter and on a defined arc, relative to its midpoint maintained or oriented in a constant alignment or cover position with the swiveling displacement axis of the angular support. In this way, the computer-controlled servo controller is used to direct the cutting course of the processing tool, by means of the angular support, so as to be exactly tangential, relative to the optical body held by the workpiece holder of the spindle head, at any desired processing point out of a set of processing point data determined by the prescription information.

In a further development of the machine according to the invention, it has been shown to be especially successful when the spindle with the workpiece holder in the spindle head is positioned so as to be rotatable, but is fixed in the axial direction relative to a base frame, and when the drive head with the tool spindle and processing tool is located on a support or skid which is separately (that is, independently of the spindle head) arranged on the base frame, whereby the skid is adjustable in the direction of and/or parallel to the axis of rotation of the spindle and workpiece holder on the spindle head, relative to the base frame. In addition, the support or skid which carries the angular support for the drive head with the tool spindle and processing tool can represent one part of a cross-shaped support or skid, which has another support or skid part which can be displaced relative to the base frame on or in which the spindle head with the workpiece holder spindle is fixed in the axial direction.

In another form of construction of a machine according to the invention, the spindle with the workpiece holder can be rotatably driven, but fixed in the axial direction, in the spindle head, while the spindle head itself is located on a support or skid which is placed on a base frame so as to be adjustable in the direction of and/or parallel to the axis of rotation of the spindle and workpiece holder, whereby the angular support for the drive head with the tool spindle and processing tool is borne by a second support or skid, which is similarly adjustably placed

on the base frame, in a direction perpendicular to the rotation axis of the spindle and workpiece holder on the spindle head.

In all of the above cases, a construction of the machine according to the invention, whereby the rotation axis of the spindle and workpiece holder on the spindle head is vertically oriented or directed in the base frame, has proven to be successful.

Obviously, however, it is also conceivable for the rotation axis of the spindle and workpiece holder on the spindle head to be horizontally oriented or directed in the base frame, when this – as in the case of DE 41 35 306 A1 – appears to be desirable or necessary. In such a case, the displaceability of both supports or skids should be entirely horizontal within the rectangular or Cartesian coordinate system, and the swiveling displacement axis for the angular support should be vertical.

An embodiment of the machine which constitutes the object of the invention is represented in the drawings attached hereto, which show:

Figure 1: a schematic spatial representation of all significant structural and functional components of a machine for material-removing processing of optical materials.

Figure 2: the functionally significant mechanical structural components of the machine according to Figure 1, viewed from the front.

Figure 3: the functionally significant mechanical structural components of the machine according to Figure 1, viewed from the right side.

Figure 4a, 4b and 4c: three different processing positions of a milling machine used as a processing tool on the same eyeglass lens, which is to be processed from an optical body – for example, a lens blank held in a block clamping device.

Figures 1 to 3 of the drawings show a machine 1, by means of which material-removing processing of optical materials for the manufacture of optical parts, especially eyeglass lenses, can be performed by means of milling and/or grinding processes, as well as a polishing process. This machine 1 has a base frame 2 and a main body 2 [Translator's note: as written in the original German document; this is an error for "a main body 3"], the back part whereof is provided with a horizontally directed guide base 4. The front part of the main body 3 contains or comprises a spindle head 5. Resting on the guide base 4 is a cross-shaped support or skid 6, consisting of two supports or skids 7 and 8 which are adjustably arranged relative to the main body 3 and to the base frame 2 in a rectangular or Cartesian coordinate system. Thereby, the support or skid 7 is arranged so as to be displaceable along the horizontal guide base 4 in the direction of the X coordinate, whereby the support or skid 8 is vertically displaceable in the direction of the Z coordinate along a guide 9 of the support or skid 7. The movements of the cross-shaped support or skid 6 are accomplished by means of two servo motors 10 and 11. Thereby, the servo motor 10 is located laterally to the main body 3 of the machine 1 and accomplishes the movement of the support or skid 7 of along the guide base 4. The servo motor 11 is located above the skid 7 and serves for the movement of the support or skid 8 along the guide 9.

Arranged on the front of the support or skid 8 is an angular support 9. This angular support 9 is movable around a horizontal swiveling displacement pin 13, which protrudes from the

front of the support or skid 8 and is aligned with an axis B-B, which runs at a right angle to the plane common to both coordinates X and Z. The angular support 12 can be swivelably displaced, in a controlled manner, around the swiveling displacement pin 13 and/or around the axis B-B. This is accomplished by means of an additional servo motor 14, which, for example, can be located on the end of the angular support 12 which is farthest removed from the swiveling displacement pin 13. In this way, the angular support is displaceable by an angle of up to 90° in both a clockwise direction of rotation and a counterclockwise direction of rotation around the swiveling displacement pin 13, relative to a vertically oriented starting position (cf. Figure 2). In other words, it is arranged so as to be swivelably displaceable by a total of 180° relative to the support or skid 8.

Fastened to the angular support 12 is a drive head 15, for example, by means of a bracket 16. The drive head exhibits a spindle 18, which may be rapidly driven in rotation by means of a drive motor 17. The spindle 18 is used to hold a processing tool 19, for example, a milling cutter or grinder. Thereby, the spindle 18 with the processing tool 19 rotates in the drive head 15 around an axis A-A, which constantly extends at a right angle to the axis B-B of the swiveling displacement pin 13 for the angular support 12, and constantly intersects that axis at a point M.

By means of the angular support 12, the drive head 15 can be moved around the swiveling displacement pin 13 and/or around its axis B-B, so that the common rotation axis A-A of the spindle 18 and the processing tool 19 is displaced at an angle in a plane which extends parallel to the plane common to both coordinates X and Z. In this connection, it is important to that the point of intersection M between the two axes A-A and B-B is also maintained in a constant alignment or cover position relative to a midpoint or a center for the cutting course of the processing tool 19, as may be clearly seen in Figures 2 and 3.

The plane on which the common rotation axis A-A of the spindle 18 and the processing tool 19 can be displaced, by means of the angular support 12, around the swiveling displacement pin 13 and/or around its axis B-B, constantly coincides with an axis C-C, around which a spindle 20 in the spindle head 5 of the main body 3 of the machine 1 can rotate, said spindle 20 being driven by a drive motor or servo motor 21. Placed on the upper, free end of the spindle 20 is a workpiece holder 22 for an optical body 23 – for example, a block clamping device for a lens blank.

The processing tool 19, which is located in the drive head 15, can be positioned and engaged, by means of the two supports or skids 7 and 8 of the cross-shaped support or skid 6, relatively to the optical body 23 – for example, the lens blank – which is held in the workpiece holder 22, for the purpose of performing the material-removing processing. Thereby, the processing tool 19 – for example, a milling cutter or grinder – is displaced by means of the drive motor 17 and the spindle 18 of the drive head 15, in rapid rotation around axis A-A. The workpiece holder 22 with the optical body 23 can also be intermittently or constantly rotated, by means of the drive or servo motor 21 and the spindle 20, around the axis C-C of the spindle head 5.

While the processing tool 19 which is located in the drive head 15 is being rotated, by means of the drive motor 17, around axis A-A, movement control takes place, not only for the two supports or skids 7 and 8 of the cross-shaped support 6 in the direction of coordinates X and Z, but also for the swiveling displacement of the angular support around axis B-B and for the rotation of optical body 23 around axis C-C of the spindle head 5, in simultaneous dependence upon a servo controller 24, which is connected to a computer 25. Accordingly,

the servo controller has a control component 24a for the servo motor 10, a control component 24b for the servo motor 11, a control component 24c for the servo motor 14, and a control component 24d for the drive or servo motor 21.

The respective prescription data are input to the computer 25 – for example, by means of a suitable input unit 26. After processing the data, the computer 25 exerts an influence on the servo controller 24 and/or on the individual components thereof 24a, 24b, 24c and 24d. These in turn act on the servo motors 10, 11, 14 and the drive or servo motor 21, so as to accomplish not only the movements of the supports or skids 7 and 8 of the cross-shaped support or skid 6, but also those of the angular support 12 and the spindle 20 of the spindle head 5 with the workpiece holder 22 and the optical body 23. Thereafter, the processing tool 19 – the milling cutter or grinder – moves from one to another of a large number of individual processing points on the optical body 23 – for example, a lens blank – in order to perform the corresponding material-removing processing and said points. During this process, it is especially important that the intersection point M between the rotation axis A-A of the processing tool 19 and the axis B-B of the swiveling displacement pin 13 of the angular support 12 is maintained in an alignment or cover position relative to a midpoint or center for the cutting course of the processing tool 19. Only in this way can it be guaranteed that, at any desired processing point on the optical body 23, optimal working conditions are maintained, so as to prevent processing errors on the optical body 23 – for example, the lens blank of an eyeglass lens.

While the total structure of the machine 1 for the material-removing processing of optical materials is shown in Figures 1 to 3, Figures 4a, 4b and 4c show three different working positions of the processing tool 19 – for example, a milling cutter – on the same optical body 23. In this connection, it should be mentioned that each of Figures 4a to 4c shows not only the workpiece holder 22, but also the optical body 23 and the processing tool 19, on a scale significantly larger than that shown in Figures 1 to 3. Moreover, the processing tool 19, according to Figures 4a to 4c, does not have a completely spherical milling head 27, as shown in Figures 1 to 3. Rather, the milling head 27 according to Figures 4a to 4c is basically shaped in the form of a truncated cone. Thereby, in the area of its free end, it is provided with a longitudinal section 28 in the form of a spherical section between two parallel bases, so that the conic center M of said longitudinal section 28 coincides with the rotation axis A-A of the processing tool 19, and additionally – and this is exceptionally important – coincides with the axis B-B of the swiveling displacement pin 13 for the angular support 12 as shown in Figures 1 to 3. Because the midpoint or center M of the longitudinal section 28 in the form of a spherical section between two parallel bases, provided on the milling head 27, lies within the truncated conic section which tapers into the shaft 29 of the processing tool 19, it is obvious that the smaller-diameter circular surface 30 of the longitudinal section 28 is located at the free end of the milling head 27 which is farthest from the shaft 29.

It should now be assumed – taking into account Figures 4a to 4c – that the optical body 23 which is fastened to the workpiece holder 22 will be used for the production of a lens 31 with two optically effective surfaces, specifically, a convex lens surface 32 and concave lens surface 33. It should also be assumed that the example shown concerns the production of the concave lens surface 33 by means of material-removing processing of the optical body 23 with the help of the machine 1.

In the performance of this material-removing processing, the intention is to ensure that the milling head 27 of the processing tool 19, in acting on each individual processing point

stipulated in the prescription data, out of a very large number of processing points, presents (insofar as possible) the same circumferential line area 34 of its longitudinal section 28. This is indicated, in each of Figures 4a to 4c, by the points of intersection of a dot-dashed line extending normally to rotation axis A-A with the circumferential surface of the longitudinal section 28.

In order for the processing tool 19 to always fulfill these conditions, irrespective of which area of curvature of the concave lens surface 13 is to be processed by it at any given moment, the milling head 27 of the processing tool 19 must constantly be displaced at an angle around its center M, which is aligned with the axis B-B. This angular displacement must be exactly and purposefully controlled by means of the angular support 12 located on the swiveling displacement pin 13, so that the predetermined circumferential line area 34-34 comes in contact with a tangent which lies against both the arc of curvature of the longitudinal section 28 and the arc of curvature of the concave lens surface 33. The various angular positions, which must be set for the rotation axis A-A of the processing tool 19 relative to the axis of revolution C-C of the optical body 23, or of the lens 31 which is processed therefrom, may be clearly recognized by comparing Figures 4a to 4c with each other.

In the case of Figure 4a, it is obvious that the processing tool 19, with the circumferential line area 34-34 of its longitudinal section 28, is operating on the processing point of the concave lens surface 33 which coincides with the point of origin 0 of its optically effective surface.

On the other hand, in the case of Figure 4b, the processing tool 19, with the same circumferential line area 34-34, has attained a processing point on the concave lens surface 33 which is far to the left of center and relatively close to the left-hand margin of the lens 31 which is being produced.

Finally, in Figure 4c, the effective position of the processing tool 19 is close to the right-hand margin of the lens 31 which is being produced, whereby the longitudinal section 28 of the processing tool 19, with its circumferential line area 34-34, is operating on a processing point close to the right-hand margin of the lens.

The totally different angular positions of the rotation axis A-A of the processing tool 19 relative to the axis B-B and/or to the midpoint M of the milling head 27, which coincides therewith, may be clearly observed in Figures 4a to 4c.

Finally, it should expressly be stated that the machine 1, with the structure and mode of operation explained above, is not limited to the use of one particular processing tool 19, as has been shown in, and explained by means of, Figures 4a to 4c.

Rather, as expressly set forth above, it is important that processing tools of every available type can be used and controlled so as to implement the material-removing processing with a greater degree of position.

List of References

1 Machine
2 Base frame
3 Main body
4 Guide base
5 Spindle head
6 Cross-shaped support or skid
7 Support or skid
8 Support or skid
9 Guide
10 Servo motor
11 Servo motor
12 Angular support
13 Swiveling displacement pin
14 Servo motor
15 Drive head
16 Bracket
17 Drive motor
18 Spindle
19 Processing tool
20 Spindle
21 Drive for servo motor
22 Workpiece holder
23 Optical body
24 Servo controller
24a, 24b, 24c, 24d Components of the server controller
25 Computer
26 Input unit
27 Milling head of processing tool 19
28 Longitudinal section in the form of a spherical section between two parallel bases
29 Shaft
30 Small circular surface of the longitudinal section 28
31 Lens
32 Convex lens surface
33 Concave lens surface
34-34 Circumferential line area of the longitudinal section 28
A-A Rotation axis of the processing tool
B-B Swivel axis of the angular support
C-C Revolution axis of the workpiece holder 22
X Movement coordinate of the support or skid 7
Z Movement coordinate of the support or skid 8

Patent Claims

1. Machine (1) for material-removing processing of optical materials for the manufacture of optical parts, especially for the manufacture of eyeglass lenses, with spherical, aspherical, toric, atoric, cylindrical or other optically effective surfaces, by means of milling and/or grinding processes, as well as polishing processes. This machine includes:

- a spindle head (5) with a rotating spindle (20), on the free end whereof is a workpiece holder (22) for an optical body (23), for example, a block clamping device for a lens blank,
- a drive head (15) with a rapidly rotating spindle (18) for the holding of a processing tool (19), for example, a milling cutter or grinding head,
- two supports or skids (7 and 8), which are adjustably arranged relative to each other and to a base frame (2) in a rectangular or Cartesian coordinate system (X, Z),
- an angular support (12), by means of which the processing tool (19) can be brought into the processing positions relative to the workpiece holder (22) and/or the optical body (23),
- whereby, by means of the supports or skids (7, 8) which can be adjusted within the coordinate system (X, Z), the processing tool (19) can be positioned and engaged against the workpiece and/or the optical body (23),
- whereby one (8) of the supports or skids (7, 8) is adjustably oriented in the direction of and/or parallel to the axis of revolution (C-C) of the spindle (20) and workpiece holder (22) on the spindle head (5), and the other support or skid (7) is adjustably oriented perpendicular to the axis of revolution (C-C) of the spindle (20) and workpiece holder (22) on the spindle head (5),
- and whereby the plane of the axis of the drive head (15) and the processing tool (19), which extends parallel to a plane defined by both coordinates of the coordinate system (X and Z), coincides with the axis of revolution (C-C) of the workpiece holder spindle (20) on the spindle head (5),

wherein:

- the angular support (12) and the processing tool (19) are controllably swivelable around an axis (B-B), which extends at a right angle to a plane defined by both coordinates (X and Z) of a rectangular or Cartesian coordinate system (X, Z),
- this swiveling displacement axis (13, B-B) is always maintained in an alignment or cover position relative to a midpoint (M) (center) for the cutting course of the processing tool (19) around the spindle rotation axis (A-A) of the drive head (15),
- and this swiveling displacement axis (13, B-B) is also constantly maintained at a right angle to the rotation axis (A-A) of the drive head (15) and/or the processing tool (19),
- whereby, in addition to the drive motor or servo motor (21) of the tool-holding spindle (20) and the servo motors (10, 11) for both supports or skids (7 and 8), an additional servo motor (14) for this swiveling displacement axis (13, B-B) of the angular support (12) is in computer-controlled connection with a servo controller (24).

2. Machine according to Claim 1, wherein the angular support (12) is provided and/or arranged so as to be displaceable by an angle of up to 90° in both a clockwise direction of rotation and a counterclockwise direction of rotation around the swiveling displacement axis (13, B-B), relative to a starting position oriented on the rotation axis (C-C) of the spindle (20) and tool holder (22) on the spindle head (5).

3. Machine according to either of Claims 1 and 2, wherein the cutting course of the processing tool (19) is provided with a defined diameter (34-34) and on a defined arc (28), relative to its midpoint (M) maintained or oriented in a constant alignment or cover position with the swiveling displacement axis (B-B, 13) of the angular support (12).

4. Machine according to any of Claims 1 to 3, wherein the cutting course of the processing tool (19) can be directed, by means of the angular support (12), so as to be exactly tangential, relative to the optical body (23) held by the workpiece holder (22) of the spindle head (5), at any desired processing point out of a set of processing point data determined by the prescription information.

5. Machine according to any of Claims 1 to 4, wherein the spindle (20) with the workpiece holder (22) in the spindle head (5) is positioned so as to be rotatable, but is fixed in the axial direction relative to a base frame (2), and when the drive head (15) with the tool spindle (18) and processing tool (19) is located on a support or skid (8) which is separately (that is, independently of the spindle head (5)) arranged on the base frame (2), whereby the skid (8) is adjustable in the direction of and/or parallel to the axis of rotation (C-C) of the spindle (20) and workpiece holder (22) on the spindle head (5), relative to the base frame (2).

6. Machine according to any of Claims 1 to 5, wherein the support or skid (8) which carries the angular support (12) for the drive head (15) with the tool spindle (18) and processing tool (19) represents one part of a cross-shaped support or skid (6), which has another support or skid part (7) which can be displaced relative to the base frame (2) on or in which the spindle head (5) with the workpiece holder spindle (20) is fixed in the axial direction.

7. Machine according to any of Claims 1 to 4, wherein the spindle (20) with the workpiece holder (22) is rotatably driven (21), but fixed in the axial direction, in the spindle head (5), while the spindle head itself is located on a support or skid which is placed on a base frame so as to be adjustable in the direction of and/or parallel to the axis of rotation of the spindle and workpiece holder, whereby the angular support for the drive head with the tool spindle and processing tool is borne by a second support or skid, which is similarly adjustably placed on the base frame, in a direction perpendicular to the rotation axis of the spindle and workpiece holder on the spindle head.

8. Machine according to any of Claims 1 to 7, wherein the axis of revolution (C-C) of the spindle (20) with the workpiece holder (22) in the spindle head (5) is vertically oriented or directed in the base frame (2).

Attached hereto are 6 pages of drawings